CORPORATE FINANCE FOR LONG-TERM VALUE

Chapter 4: Discount rates and scarcity of capital

Part 2: Discount rates and valuation methods

Chapter 4: Discount rates and scarcity of capital

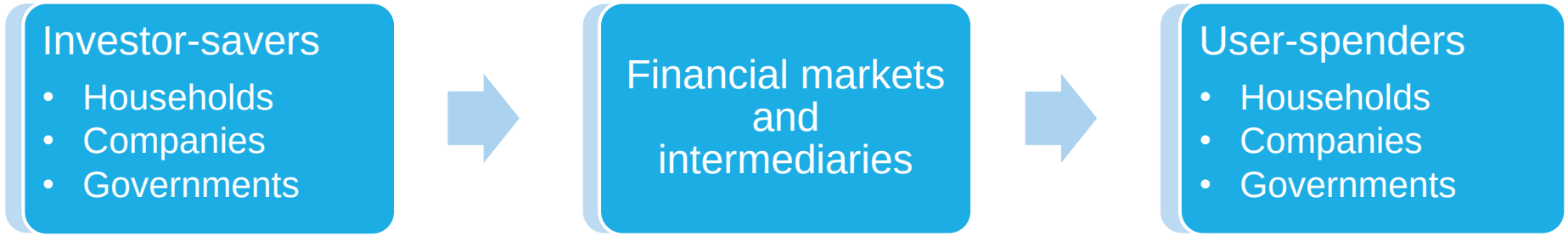
The BIG Picture

- Discounting reflects the time value of money
- Also other components: premium for market risk, credit risk, liquidity risk

- Financial discount rates are used for FV and depend on
  - supply and demand of funds in financial markets
  - government policies + central banks setting ST interest rates

- Social discount rates are used for SV and EV
  - Company's counterparties are societal stakeholders: employees, clients, suppliers, environment (= current + future generations)
  - Big question: should current and future generations be treated equal?

Demand and supply of financial funds



- A large supply of funds relative to demand lowers the price or discount rate of financial capital
- Financial markets are influenced by
  - Government policies: regulations to ensure a proper functioning of financial markets
  - Central banks setting short-term interest rates

Time value of money

- People prefer money today over money tomorrow due to inflation and opportunity costs
- The difference in value between money now and money in the future is called the *time value of money*
- The difference is calculated with a *discount rate*, which is the interest rate *r* used to determine the *present value* (*PV*) of future cash flows
- The *discount factor* is the factor by which a future cash flow over *n* periods must be multiplied to obtain the *PV*:

$$\textbf{discount factor} = \frac{1}{(1+r)^n}$$

Net Present Value (NPV)

- *Net Present Value* (*NPV*) is the present value of a stream of cash flows
- Example with a *discount rate* of $r = 0.03 = 3\%$
- Calculation for *discount factor* in 2024 ($n = 2$):

  $1 / (1 + 0.03)^2 = 1 / 1.0609 = 0.943$
- *PV* of cash flow in 2024 = 30 x 0.943 = 28.3

Year	2022	2023	2024	2025	2026	2027	2028
Cash flow	-1,000	30	30	30	30	30	1,030
Discount factor	1	0.971	0.943	0.915	0.888	0.863	0.837
PV	-1,000	29.1	28.3	27.5	26.7	25.9	862.6
NPV	**0**						

Arbitrage and law of one price

- *Arbitrage* = the buying and selling of ‘equivalent’ or ‘similar’ goods in different markets to benefit from price differences (exceeding transaction costs)
- *Arbitrage opportunity* = situation in which it is possible to make a profit from an investment without taking risk (‘free lunch’)
- Arbitrage only works if the **law of one price** does not hold, which says that the same product should sell at the same price
- Finance predicts that arbitrage profits (NPVs) will often be zero: competition between investors will quickly result in the adjustment of prices of over- or under-priced securities

Law of one price in Finance

- Finance predicts that arbitrage profits (NPVs) will often be zero:

  competition between investors will quickly result in the adjustment of prices of over- or under-priced securities

- Law of one price is underlying many calculations and valuations

  -> two securities that generate the same payoff must cost the same

  - Yields of bonds with same maturity, credit risk and liquidity risk (Ch8)
  - Modigliani-Miller theorem on capital structure (Ch15)
  - Options pricing – put-call parity (Ch19)
  - Etc.

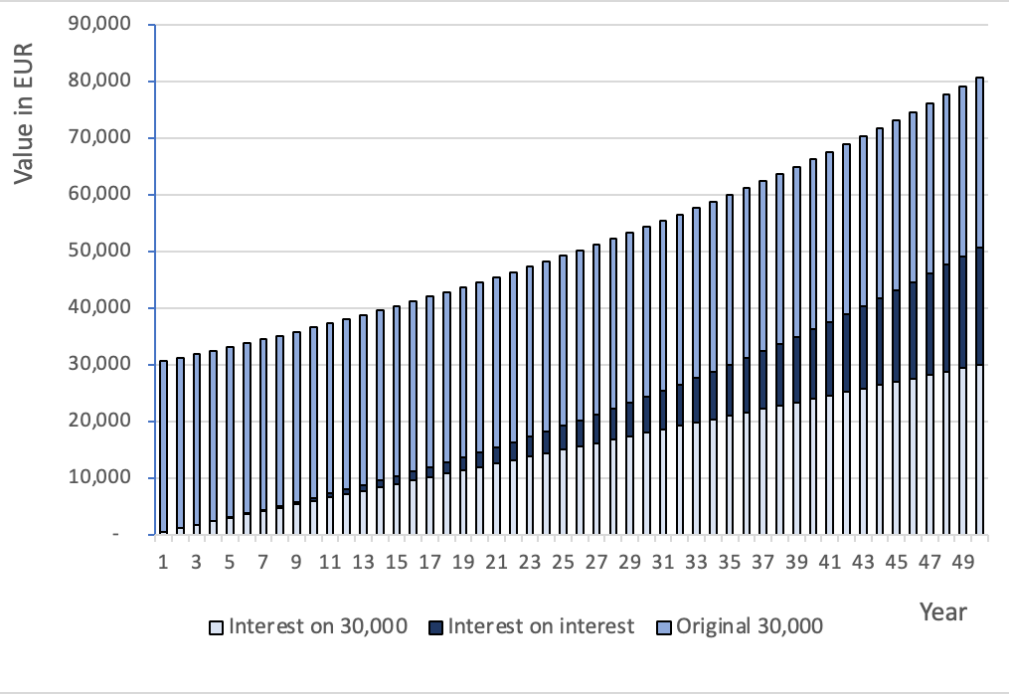
Principal financial markets

- **Money market** - for short-term funds up to one year
- **Bond markets** - most important segment of the market for debt securities, with a maturity of more than one year
- **Equity markets** – companies issue equity to raise funds
- **Derivatives market** - financial instruments whose value is derived from the value of the underlying financial instruments
- **Foreign exchange market –** determines relative currency value

Compounding

- *Compounded interest* is the interest received over the interest already stored in saving accounts

Value composition with compounding returns



Capital with and without compounding

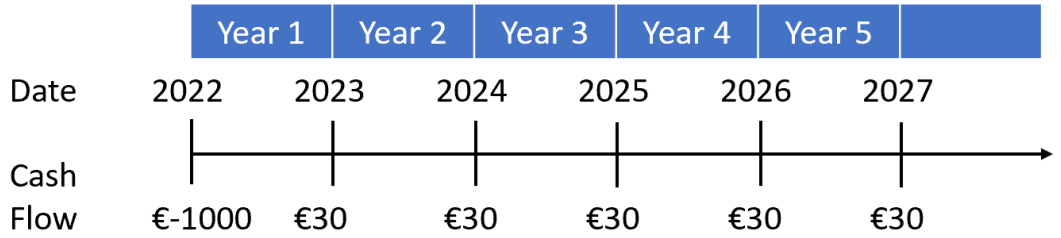
Year	2% not compounded		2% compounded	
	Capital	Return	Capital	Return
1	30,000	600	30,600	600
2	30,000	600	31,212	612
3	30,000	600	31,836	624
4	30,000	600	32,473	637
5	30,000	600	33,122	649
..				
49	30,000	600	79,164	1,552
50	30,000	600	80,748	1,583

Return from different compounding rates

Annual return	Years				
	10	20	30	40	50
2%	36,570	44,578	54,341	66,241	80,748
4%	44,407	65,734	97,302	144,031	213,201
8%	64,768	139,829	301,880	651,736	1,407,048

Perpetuities & Annuities

- A *perpetuity* is a stream of regular and equal cash flows into infinity
- Formula: $PV = \frac{CF}{r}$
- At 3%: $PV = \frac{CF}{r} = \frac{30}{0.03} = 1{,}000$

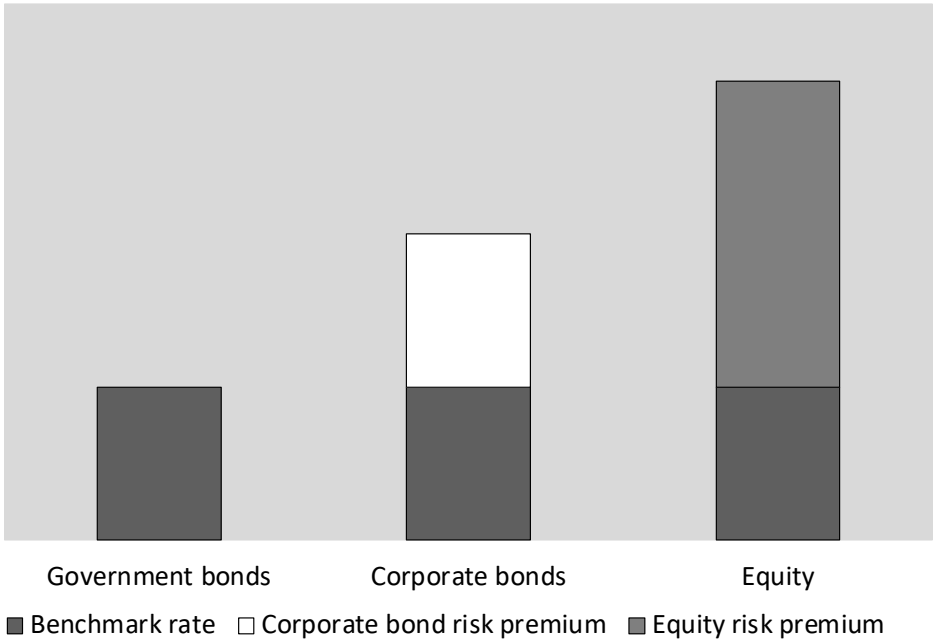


- Law of one price holds: *PV* of perpetuity (1,000) is equal to cost to create it (1,000)

- An *annuity* is a stream of equal cash flows paid at regular intervals, with an end-date *N*
- Formula: $PV = \frac{CF}{r} \cdot \left(1 - \frac{1}{(1+r)^N}\right)$

Opportunity cost of capital

- What discount rate should investors use when discounting their expected cash flows?
- The *opportunity cost of capital* is the best available return on an investment that has risk and conditions similar to the cash flows to be discounted
- There are many determinants of discount rates, split into:
  - Components that drive government bond yields (benchmark rate)
  - Components that drive the premium:
    - corporate bond premium
    - equity premium

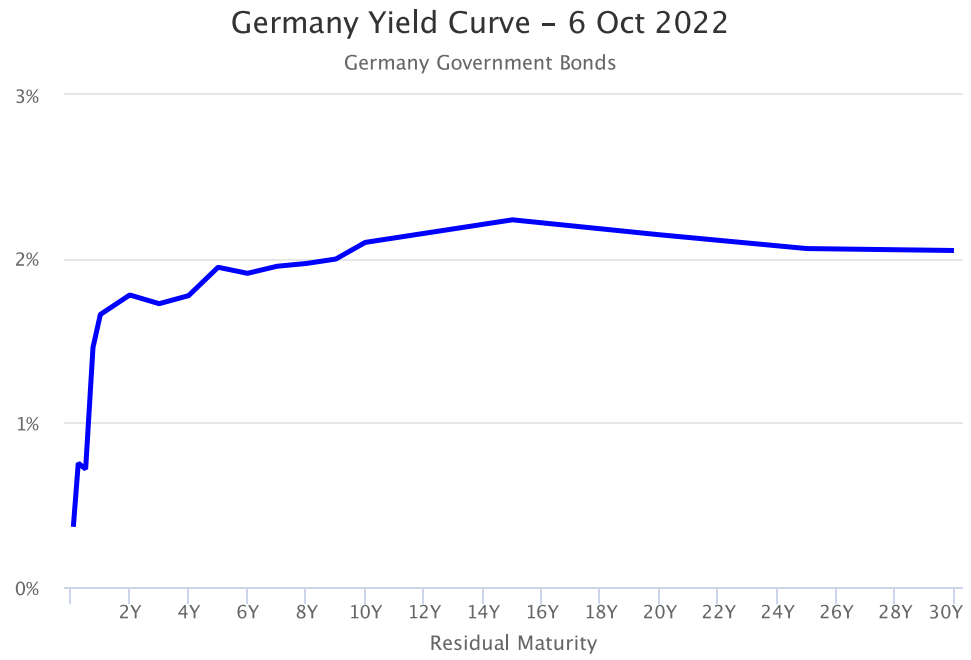


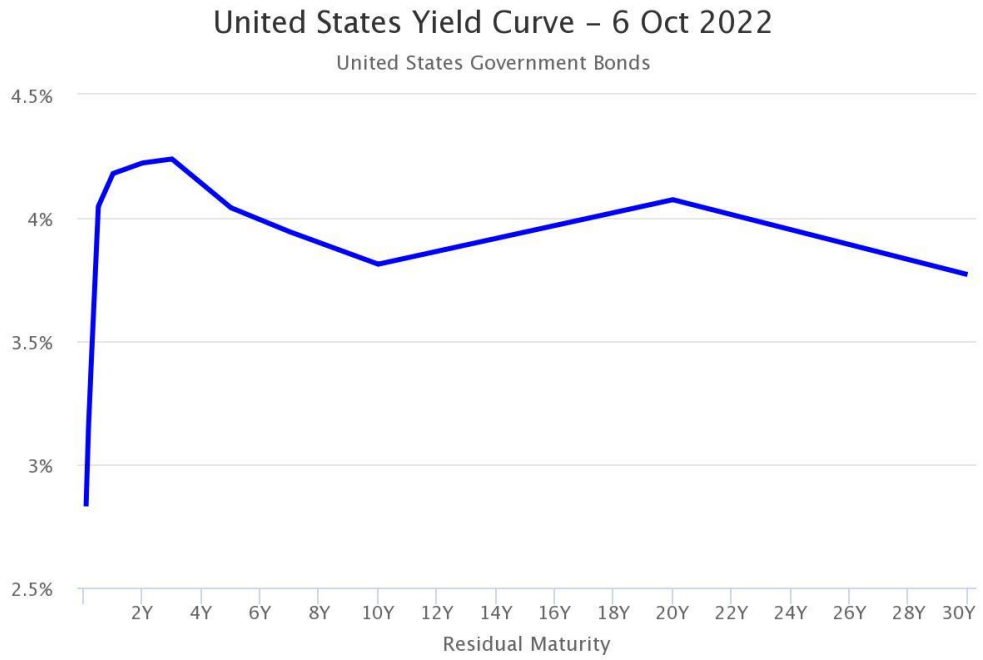
Benchmark – government bonds

- The highest quality government securities are considered ‘risk-free’
- Market discount rates are the benchmarks against which discount rates are determined
- Yields of government bonds are influenced by expected short-term interest rates and the term premium
- Risk-averse investors demand a *term premium* (or risk premium) for investments in long-term bonds
- The term premium leads to a positive *term spread*, which is the difference between yields for bonds with longer maturity and yields for bonds with shorter maturity

Government bond yield curve

- A positive term spread reflects what is often called a ‘normal’ yield curve
- A *yield curve* is a visualisation of the term structure, which is the relation between yields (in %) and maturities (in years) of otherwise similar bonds





Credit risk

- Apart from interest rate expectations and the term premium, *credit risk* and *liquidity* also influence government bond yields
- *Credit risk premium* is the spread between the yield of a particular bond and the yield of a bond with similar characteristics but without credit risk
- Rating agencies (Moody's, S&P, Fitch) indicate issuers' credit risk by assigning them a *credit rating, (*AAA, A+, BBB-, etc.)
- Drivers of country credit rating differences: per capita income, GDP growth, inflation, external debt, economic development and default history

Liquidity

- *Liquidity* is the ease with which an investor can sell or buy a bond immediately at a price close to the market price
- *Liquidity premium* is the spread between the yield of a bond with high liquidity and a similar bond with less liquidity
- Example
  - A very liquid 1-yr government bond may trade at a yield of 4.17%
  - And a a less liquid 1-jr gov bond at a yield of 4.30%
    - Liquidity premium is then 13 basis points (4.30% - 4.17% = 0.13%)

Corporate bonds – yield

- *Default risk* is the risk that a bond will not make its promised payments. This is higher for corporate bonds since, unlike governments, they do not have the option of raising taxes to meet their payment obligations
- *Corporate yield spread* is the difference between yields on corporate bonds and government bonds with the same maturity and rating
- The corporate yield spread can be calculated per rating class and per maturity

	1 year	5 year	10 year	20 year
AAA corporate bonds	4.39%	4.30%	4.39%	4.61%
AAA government bonds	4.07%	3.85%	3.65%	4.04%
AAA corporate yield spread	**0.31%**	**0.45%**	**0.75%**	**0.57%**

Equities – market risk premium

- Shareholders are *residual claimants* as they are paid only after other stakeholders have been paid
- As a result, equity typically carries a higher risk than corporate bonds
- The *equity risk premium* is the expected excess return of equities over the risk-free rate
- The equity risk premium tends to be higher for smaller companies, more cyclical companies, and companies with weaker corporate governance

Discounting social and environmental capital

- The counterparty of companies' social and environmental capital is the wider society, representing current and future generations. This raises two fundamental and ethical questions:
  - Should current and future generations be treated equally?
  - What is the appropriate discount rate for society (the social discount rate)?
- Equal treatment of current and future generations implies a zero time preference between current and future generations

Discounting social and environmental capital

- Ramsay (1928) defined the discount rate r^s for societal projects as:

$$r^s = \delta + \eta \cdot g$$

δ = time preference between current and future generations
g = growth rate
η = elasticity of marginal utility of consumption

	Social discount rate $r^s = \delta + \eta \cdot g$		with $g = 1.3\%$
Author	**Time preference δ**	**Elasticity η**	**Discount rate r^s**
Cline (1992)	0%	1.5	1.95%
Nordhaus (1994)	3%	1	4.3%
Stern (2006)	0.1%	1	1.4%

- Dasgupta (2021) finds that the vast majority of economists find a social discount rate of 1 to 3% appropriate for long-run public projects
  - Nordhaus (1994) with 4.3% is the exception

Discounting integrated capital

- We assume a social discount rate of 2% (middle of Dasgupta's 1% to 3% range)

Financial balance sheet for a standard company

	Value	*Discounted at*		*Value*	*Discounted at*
F net operating assets	100	8.0%	F debt	20	4.0%
			F equity	80	9.0%
F capital	100	8.0%	F capital	100	8.0%

- Cost of capital = (20/100) x 4% + (80/100) x 9% = **8%**

Integrated balance sheet for Company A with ***positive*** net assets on environmental value (EV)

	Value	*Discounted at*		*Value*	*Discounted at*
F net operating assets	100	8.0%	F debt	20	4.0%
E net assets	20	2.0%	F equity	80	9.0%
			E equity	20	2.0%
Integrated capital	120	7.0%	Integrated capital	120	7.0%

- Integrated cost of capital = (20/120) x 4% + (80/120) x 9% + (20/120) x 2% = **7%**

Integrated balance sheet for Company B with ***negative*** net assets on environmental value (EV)

	Value	*Discounted at*		*Value*	*Discounted at*
F net operating assets	100	8.0%	F debt	20	4.0%
E net assets	-20	2.0%	F equity	80	9.0%
			E equity	-20	2.0%
Integrated capital	80	9.5%	Integrated capital	80	9.5%

- Integrated cost of capital = (20/80) x 4% + (80/80) x 9% - (20/80) x 2% = **9.5%**

Internalisation

- Similar starting financial balance can be different after (the anticipation of) internalisation of social and environmental externalities
- The empirical prediction is:
  - Companies with large social and environmental liabilities will have a higher cost of integrated capital
  - Companies with social and environmental assets will enjoy a lower cost of integrated capital
- The risk premium will rise when the risk of internalisation rises

Conclusions

- Present values and discount rates are needed when considering the future in investment decisions
- The counterparty of companies' social and environmental capital is the wider society, representing current and future generations
- An equal treatment of current and future generations implies a low social discount rate
- Larger environmental and social liabilities raise the cost of integrated capital, while environmental and social assets lower the cost of integrated capital